

AMENDMENTS TO THE CLAIMS:

Please cancel without prejudice claims 19 and 34 and amend claims 18, 20, 33 and 35 as follows.

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (*Previously Presented*) A photovoltaic device comprising:
a plurality of quantum wells and
a plurality of barriers, said barriers alternating with said quantum wells, one of
said plurality of quantum wells and said plurality of barriers comprised of tensile strained
layers and the other of said plurality of quantum wells and said plurality of barriers
comprised of compressively strained layers, said tensile strained layers and said
compressively strained layers having compositions such that a period of one tensile
strained layer and one compressively strained layer exerts substantially no shear force on
a neighbouring structure.

2. (*Previously Presented*) A photovoltaic device as claimed in claim 1, wherein
said neighbouring structure is one of:

a further period of one tensile strained layer and one compressively strained layer;
a layer of arbitrary doping having a lattice constant; and
a substrate having a lattice constant.

3. (*Original*) A photovoltaic device as claimed in claim 1, being a crystalline photovoltaic device grown upon a substrate with a substrate lattice constant.

4. (*Previously Presented*) A photovoltaic device as claimed in claim 3, wherein at least one of said tensile strained layers or said compressively strained layers is a quantum well having a lattice constant not equal to said substrate lattice constant and having a Group III/V semiconductor composition with a bandgap lower than if said quantum well had a lattice constant equal to said substrate lattice constant.

5. (*Previously Presented*) A photovoltaic device as claimed in claim 3, wherein at least one of said tensile strained layers or said compressively strained layers is a barrier having a lattice constant not equal to said substrate lattice constant and a Group III/V semiconductor composition with a bandgap higher than if said barrier had a lattice constant equal to said substrate lattice constant.

6. (*Original*) A photovoltaic device as claimed in claim 1, wherein said multiple quantum well portion is formed of alternating quantum well layers and barrier layers having a Group III/V semiconductor composition, wherein a period of one quantum well layer and one quantum barrier layer contains at least four different elements and has an average lattice constant substantially matching a neighbouring structure lattice constant.

7. *(Original)* A photovoltaic device as claimed in claim 4, wherein said substrate is InP and said compressively strained layer is $In_xGa_{1-x}As$, where $x > 0.53$.

8. *(Original)* A photovoltaic device as claimed in claim 5, wherein said substrate is InP and said tensile strained layer is $In_xGa_{1-x}As_{1-y}P_y$, where $y > 0$.

9. *(Original)* A photovoltaic device as claimed in claim 8, wherein $y = 1$ such that said tensile strained layer is GaInP.

10. *(Original)* A photovoltaic device as claimed in claim 3, wherein said substrate is InP and said multiple quantum well portion is formed of layers of $Al_xGa_{1-x}As_ySb_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$.

11. *(Original)* A photovoltaic device as claimed in claim 3, wherein said substrate is GaSb and said multiple quantum well portion is formed of layers of $In_xGa_{1-x}As_ySb_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$.

12. *(Original)* A photovoltaic device as claimed in claim 3, wherein said substrate is GaAs.

13. (*Original*) A photovoltaic device as claimed in claim 12, wherein said multiple quantum well portion is formed of layers of $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$.

14. (*Original*) A photovoltaic device as claimed in claim 1, wherein said multiple quantum well portion is formed upon a virtual substrate composed of a strain relaxed buffer layer having a virtual substrate lattice constant different from a substrate lattice constant of an underlying substrate.

15. (*Original*) A photovoltaic device as claimed in claim 14, wherein said virtual substrate is $\text{InP}_{1-y}\text{As}_y$, where $0 < y < 1$, and said substrate is InP.

16. (*Original*) A photovoltaic device as claimed in claim 1, wherein said photovoltaic device is a thermophotovoltaic device.

17. (*Original*) A photovoltaic device as claimed in claim 1, wherein said quantum wells have a bandgap substantially equal to or less than 0.73eV

18. (*Currently Amended*) A photovoltaic device having a multiple well quantum portion formed upon a virtual substrate having a virtual substrate lattice constant different than a substrate lattice constant of an underlying substrate, wherein said virtual substrate is $\text{InP}_{1-x}\text{As}_x$, where $0 < x < 1$, and said substrate is InP, wherein said multiple quantum well

portion is formed with alternating tensile strained layers and compressively strained layers, said tensile strained layers and said compressively strained layers having compositions such that a period of one tensile strained layer and one compressively strained layer exerts substantially no shear force on a neighbouring structure.

19. (*Cancelled*).

20. (*Currently Amended*) A photovoltaic device as claimed in claim 1918, wherein said neighbouring structure is one of:

a further period of one tensile strained layer and one compressively strained layer;
a layer of arbitrary doping having the same lattice constant as said virtual substrate; and
said virtual substrate.

21. (*Previously Presented*) A photovoltaic device as claimed in claim 20, wherein at least one of said tensile strained layers or said compressively strained layers is a quantum well having a lattice constant not equal to said substrate lattice constant and a Group III/V semiconductor composition with a bandgap lower than if said quantum well had a lattice constant equal to said substrate lattice constant.

22. (*Previously Presented*) A photovoltaic device as claimed in claim 20, wherein at least one of said tensile strained layers or said compressively strained layers is a barrier having a lattice constant not equal to said substrate lattice constant and a Group III/V semiconductor composition with a bandgap higher than if said barrier had a lattice constant equal to said substrate lattice constant.

23. (*Original*) A photovoltaic device as claimed in claim 18, wherein said multiple quantum well portion is formed of alternating quantum well layers and barrier layers having a Group III/V semiconductor composition, wherein a period of one quantum well layer and one quantum barrier layer contains at least four different elements and has an average lattice constant substantially matching a neighbouring structure lattice constant.

24. (*Original*) A photovoltaic device as claimed in claim 21, wherein said substrate is InP and said compressively strained layer is $In_xGa_{1-x}As$, where x is larger than z of $In_zGa_{1-z}As$ which is lattice-matched to the virtual substrate.

25. (*Original*) A photovoltaic device as claimed in claim 23, wherein said substrate is InP and said tensile strained layer is $In_xGa_{1-x}As_{1-y}P_y$, where $y > 0$.

26. (*Original*) A photovoltaic device as claimed in claim 25, wherein $y=1$ such that said tensile strained layer is GaInP or wherein $x=1$ such that said tensile strained layer is InAsP.

27. (*Original*) A photovoltaic device as claimed in claim 18, wherein said substrate is InP and said multiple quantum well portion is formed of layers of $Al_xGa_{1-x}As_ySb_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$.

28.-30. (*Cancelled*)

31. (*Original*) A photovoltaic device as claimed in claim 18, wherein said photovoltaic device is a thermophotovoltaic device.

32. (*Original*) A photovoltaic device as claimed in claim 18, wherein said quantum wells have a bandgap substantially equal to or less than 0.73eV

33. (*Currently Amended*) A photovoltaic device having a multiple quantum well portion formed of strained alternating quantum well layers of $In_xGa_{1-x}As$, where $x > 0.53$, and barrier layers of $Ga_yIn_{1-y}P$, where $y > 0$, wherein said multiple quantum well portion is formed with alternating tensile strained layers and compressively strained layers, said tensile strained layers and said compressively strained layers having compositions such

that a period of one tensile strained layer and one compressively strained layer exerts substantially no shear force on a neighbouring structure.

34. (*Cancelled*).

35. (*Currently Amended*) A photovoltaic device as claimed in claim 3433, wherein said neighbouring structure is one of:

a further period of one tensile strained layer and one compressively strained layer;
a layer of arbitrary doping having a lattice constant; and
a substrate having a lattice constant.

36. (*Original*) A photovoltaic device as claimed in claim 33, being a crystalline photovoltaic device grown upon a substrate layer with a substrate lattice constant.

37. (*Original*) A photovoltaic device as claimed in claim 36, wherein said substrate is InP.

38. (*Original*) A photovoltaic device as claimed in claim 33, wherein said multiple quantum well portion is formed upon a virtual substrate composed of a strain relaxed buffer layer having a virtual substrate lattice constant different from a substrate lattice constant of an underlying substrate.

39. (*Original*) A photovoltaic device as claimed in claim 38, wherein said virtual substrate is $\text{InP}_{1-y}\text{As}_y$, where $0 < y < 1$, and said substrate is InP.

40. (*Original*) A photovoltaic device as claimed in claim 33, wherein said photovoltaic device is a thermophotovoltaic device.

41. (*Original*) A photovoltaic device as claimed in claim 33, wherein said quantum wells have a bandgap substantially equal to or less than 0.73eV.

42. (*Previously Presented*) A photovoltaic device as claimed in claim 1, wherein said quantum wells comprise said compressively strained layers.

43. (*Previously Presented*) A photovoltaic device as claimed in claim 1, wherein said barriers comprises said tensile strained layers.

44. (*Previously Presented*) A photovoltaic device having a substrate with a substrate lattice constant a_0 and multiple quantum well portion with alternating tensile strained layers with a lattice constant a_1 , a thickness t_1 and elastic stiffness coefficients C_{11} and C_{12} and compressively strained layers with a lattice constant a_2 , a thickness t_2 and elastic stiffness coefficients C_{21} and C_{22} , said tensile strained layers and said

compressively strained layers having compositions such that a period of one tensile strained layer and one compressively strained layer substantially meets the conditions:

$$\varepsilon_1 t_1 A_1 a_2 + \varepsilon_2 t_2 A_2 a_1 = 0; \text{ and}$$

$$a_0 = \frac{t_1 A_1 a_1 a_2^2 + t_2 A_2 a_2 a_1^2}{t_1 A_1 a_2^2 + t_2 A_2 a_1^2};$$

where

$$A_1 = C_{11} + C_{12} - \frac{2C_{12}^2}{C_{11}};$$

$$A_2 = C_{21} + C_{22} - \frac{2C_{22}^2}{C_{21}};$$

$$\varepsilon_1 = \frac{a_0 - a_1}{a_1}; \text{ and}$$

$$\varepsilon_2 = \frac{a_0 - a_2}{a_2}$$

45. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein at least one of said tensile strained layers or said compressively strained layers is a quantum well having a Group III/V semiconductor composition with a bandgap lower than if said quantum well had a lattice constant equal to said substrate lattice constant.

46. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein at least one of said tensile strained layers or said compressively strained layers is a barrier having a Group III/V semiconductor composition with a bandgap higher than if said barrier had a lattice constant equal to said substrate lattice constant.

47. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said multiple quantum well portion is formed of alternating quantum well layers and barrier layers having a Group III/V semiconductor composition, wherein a period of one quantum well layer and one quantum barrier layer contains at least four different elements and has an average lattice constant substantially matching a neighbouring structure lattice constant.

48. (*Previously Presented*) A photovoltaic device as claimed in claim 45, wherein said substrate is InP and said compressively strained layer is $\text{In}_x\text{Ga}_{1-x}\text{As}$, where $x>0.53$.

49. (*Previously Presented*) A photovoltaic device as claimed in claim 46, wherein said substrate is InP and said tensile strained layer is $\text{In}_x\text{Ga}_{1-x}\text{As}_{1-y}\text{P}_y$, where $y>0$.

50. (*Previously Presented*) A photovoltaic device as claimed in claim 49, wherein $y=1$ such that said tensile strained layer is GaInP.

51. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said substrate is InP and said multiple quantum well portion is formed of layers of $\text{Al}_x\text{Ga}_{1-x}\text{As}_y\text{Sb}_{1-y}$, where $0\leq x\leq 1$ and $0\leq y\leq 1$.

52. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said substrate is GaSb and said multiple quantum well portion is formed of layers of $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{Sb}_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$.

53. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said substrate is GaAs.

54. (*Previously Presented*) A photovoltaic device as claimed in claim 53, wherein said multiple quantum well portion is formed of layers of $\text{In}_x\text{Ga}_{1-x}\text{As}_y\text{P}_{1-y}$, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$.

55. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said substrate is a virtual substrate composed of a strain relaxed buffer layer having a virtual substrate lattice constant different from a substrate lattice constant of an underlying substrate.

56. (*Previously Presented*) A photovoltaic device as claimed in claim 55, wherein said virtual substrate is $\text{InP}_{1-y}\text{As}_y$, where $0 < y < 1$, and said substrate is InP.

57. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said photovoltaic device is a thermophotovoltaic device.

58. (*Previously Presented*) A photovoltaic device as claimed in claim 44, wherein said quantum wells have a bandgap substantially equal to or less than 0.73eV